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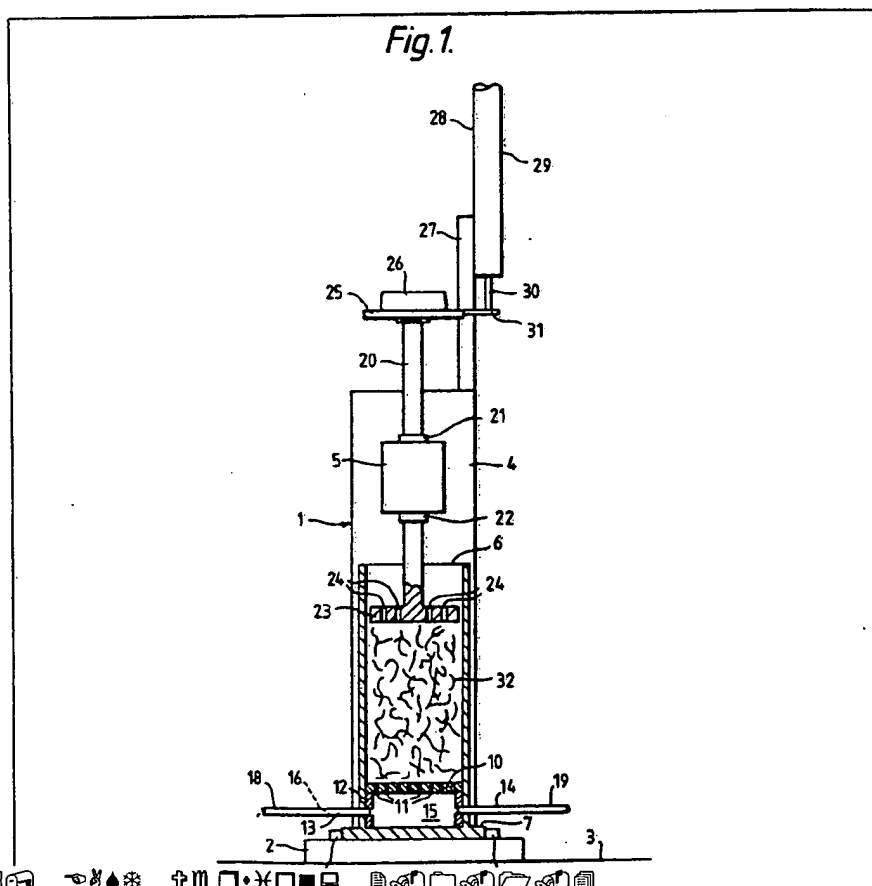
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(54) Improvements relating to to-
bacco test apparatus

(57) An apparatus for the simulta-
neous measurement of the filling
value and the gas-flow impedance
of tobacco comprises a cylinder 6
having a gas-permeable sample
supporting platform 10 extending
across its interior. A piston 23
which is also gas-permeable is ar-
ranged for movement under gravity
within the cylinder. The interior 15
of the cylinder beneath the platform
may be connected to a suction
pump and a manometer via tubes
18, 19 respectively so that the
pressure drop across sample 32
may be made at two minute inter-
vals. The piston 23 is allowed to
fall under gravity and a linear vari-
able differential transformer 29 con-
tinuously monitors its position and
provides a record at two minute

intervals. Weights 26 are added to
the piston at eight minute intervals.



GB 2 128 758 A

Fig. 1.

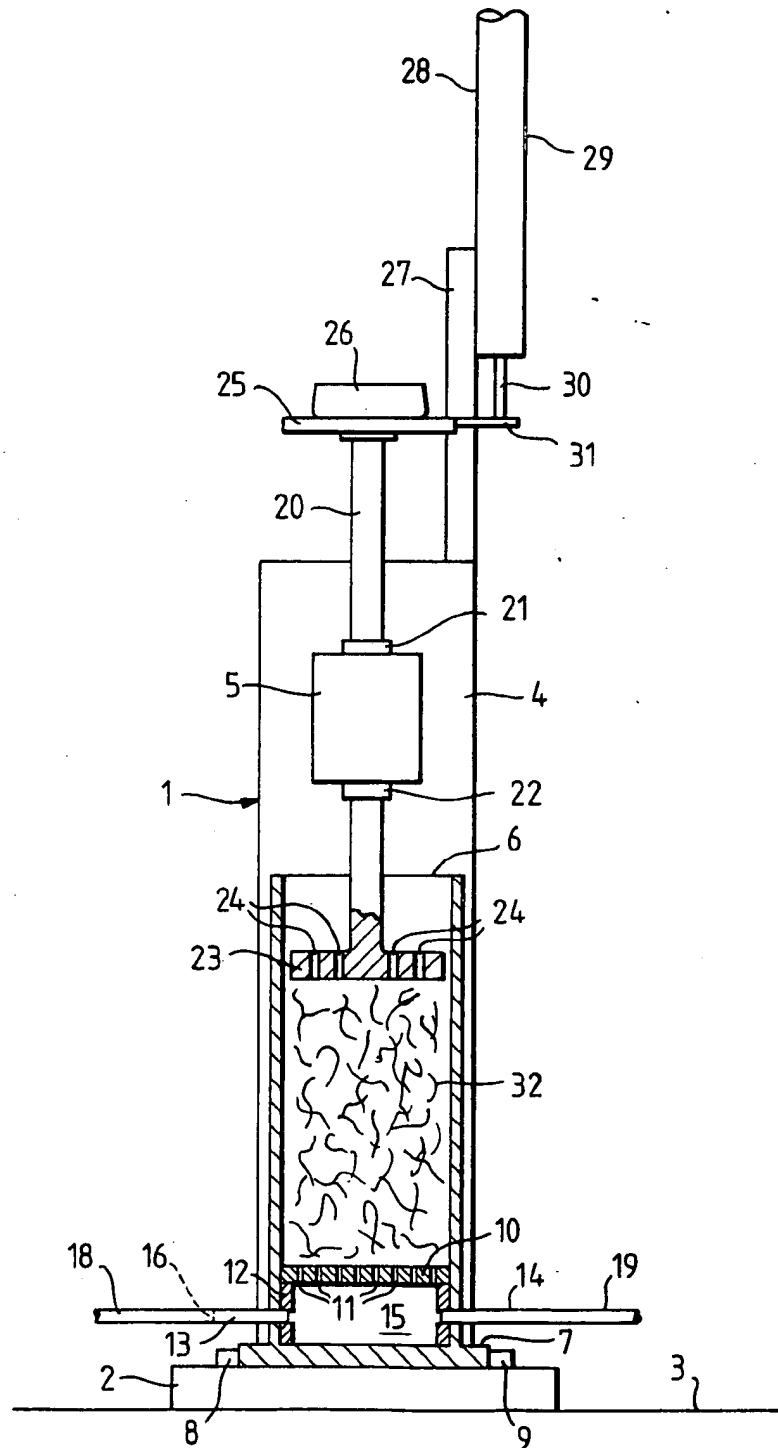
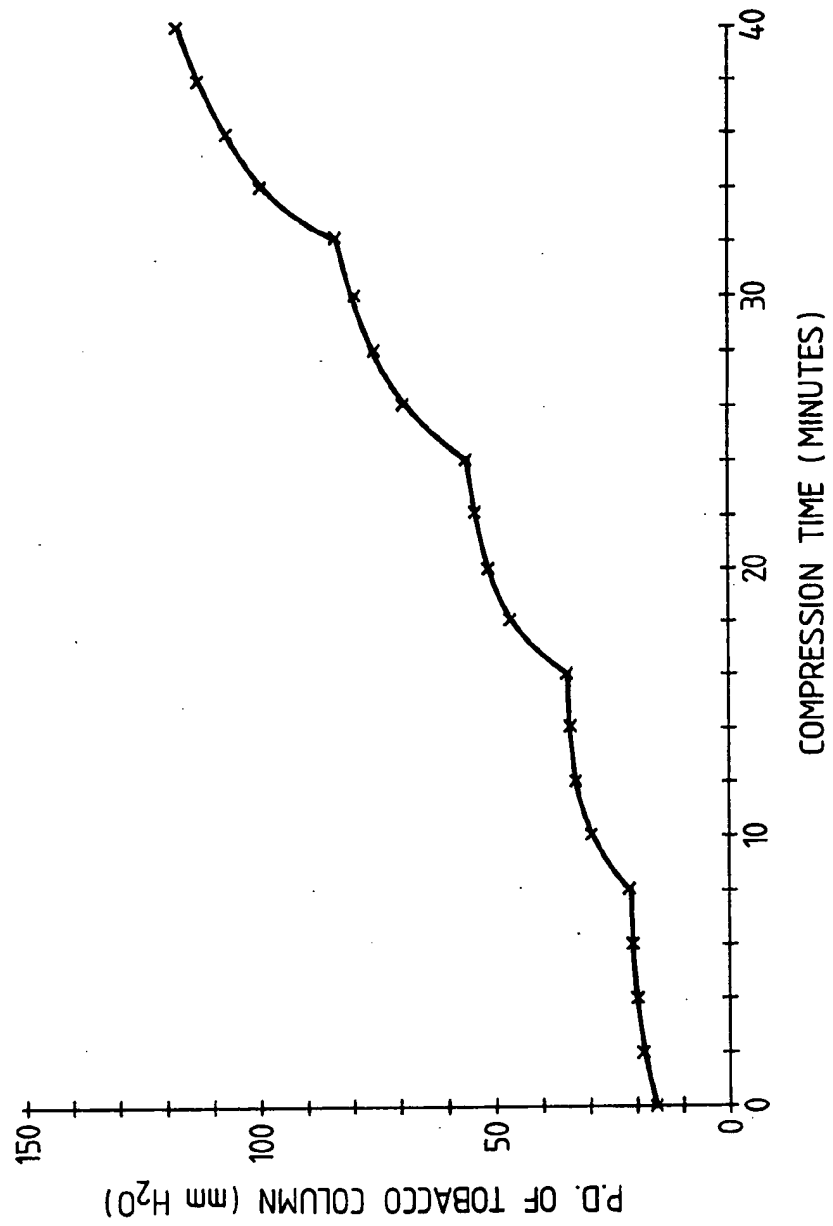
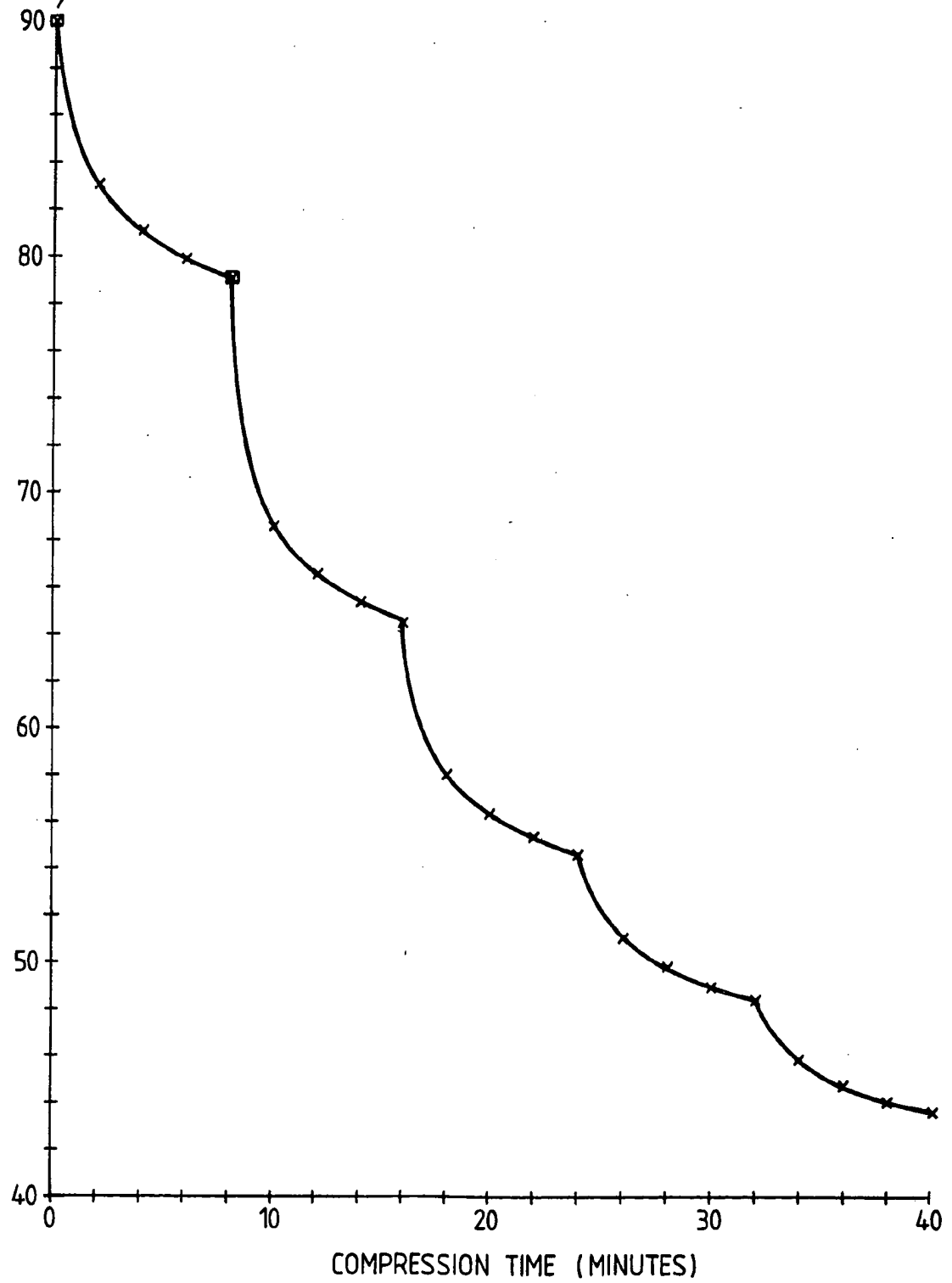


Fig.2.



*Fig.3.*HEIGHT OF TOBACCO
COLUMN (mm)

SPECIFICATION

Improvements relating to tobacco test apparatus

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This invention relates to apparatus for use in the determination of the physical character of particulate material, cut tobacco for example.

It is established practice to make determinations of the physical character of cut tobaccos in order, for example, to match a tobacco with a cigarette design specification. One important physical property of cut tobacco is filling value. The filling value of a tobacco determines the firmness value of cigarettes the fillers of which are constituted by the tobacco. Another physical property of tobacco which, for cigarette design purposes, it is useful to have knowledge of, is effective density, also known as tobacco particle density. The effective density of cut tobacco may be calculated from measurements of the volume and air-flow impedance of the cut tobacco.

The present invention provides apparatus for use in the determination of filling value and gas-flow impedance of tobacco, comprising a cylinder, a piston movable in said cylinder towards tobacco support means extending across the interior of said cylinder, each of said piston and said tobacco support means being permeable to gas flow thereacross, and gas-flow duct means communicable with a chamber to the side of said tobacco support means remote from said interior of said cylinder and bounded by said tobacco support means.

The gas-flow pressure drop across the piston plus the tobacco support means measured when there is no tobacco in the cylinder should be low, preferably not exceeding 1 mm water gauge. The preferred shape of the cross-section of the interior of the cylinder is circular. The piston should preferably be so dimensioned as to be clear of the cylinder wall throughout its travel in the cylinder, although upper parts of the piston may be in contact with the cylinder wall.

The provision according to the present invention of a single apparatus by which simultaneous determinations may be made of volume, filling value and gas-flow impedance, and, by calculation, of effective density, of a sample of tobacco makes possible savings in both capital and revenue costs. Reductions in sampling error are also to be expected since measurements for each of the physical characteristics are made on the same sample.

In order that the invention may be clearly understood and readily carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:—

Figure 1 shows, diagrammatically, a front elevation, partly in section, of an apparatus

for use in the determination of the filling value

and the air-flow impedance of a sample of cut tobacco; and

Figures 2 and 3 show plots against time of pressure drop across a column of tobacco and height of the column respectively.

The apparatus shown in Fig. 1 comprises a rigid metal frame generally designated 1 and comprising a base plate 2, shown supported on a horizontal surface 3, a pillar 4 extending upwardly from the base plate 2, and a guide block 5 secured to the pillar 4 at an upper end region thereof.

Reference numeral 6 designates a brass cylinder shown in axial section. The cylinder 6, which has an internal diameter of 63.5 mm, is open at its upper end, its lower end being closed by an integral plate 7. Straight and parallel sides of the plate 7 are receivable as a sliding fit against locating bars 8, 9 secured to the upper surface of the base plate 2. When the plate 7 is disposed between the bars 8, 9 and the rear edge of the plate 7 is in contact with the front face of the pillar 4, the cylinder 6 is in an operative position thereof relative to the frame 1.

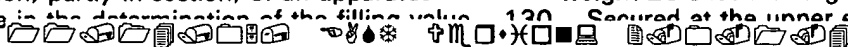
Extending across the interior of the cylinder 6, at a location near to the lower end thereof, is a brass disc 10 providing sample-supporting platform means. Extending through the disc 10 are a number of bores 11. There may for example be one hundred and eight bores each of 1.5 mm diameter. A sleeve 12, which at its lower end rests on the plate 7, serves to support the disc 10.

Ducts 13 and 14 extend through the wall of the cylinder 6 and the sleeve 12 to communicate with chamber 15 which is bounded by the plate 7, the disc 10 and the sleeve 12. Positioned within the duct 13 is a critical flow orifice 16. Flexible tubes 18 and 19 are secured over the outer ends of the ducts 13 and 14 respectively. The tube 18 extends to a suction pump (not shown) and the tube 19 extends to a micromanometer 19 (also not shown).

The guide block 5 serves to accurately guide a piston rod 20 for reciprocal movement co-axially of the cylinder 6 when the cylinder 6 is in the above mentioned operative position thereof. The piston rod 12 is located in the block 5 by upper and lower, low friction bearing bushes 21 and 22. A piston in the form of disc 23 is carried by the piston rod 20 at the lower end thereof. Extending through the piston 23 are a number of bores 24. There may for example be thirty-two bores each of 2 mm diameter. When the piston 23 is within the cylinder 6 there is a radial clearance between the piston 23 and the wall of the cylinder 6 of 2.5 mm.

Mounted at the upper end of the piston rod 20 is a circular platform 25 on which may be placed one or more weights such as the weight 26 shown in Fig. 1.

Secured at the upper end of the pillar 4 and



extending upwardly therefrom is a bracket member 27 which serves to fixedly support the body 28 of a linear variable differential transformer (LVDT) 29, a lower portion only of which is shown in Fig. 1. The movable core 30 of the LVDT extends downwardly into contact with the upper surface of a finger element 31 which is secured to and extends horizontally from the platform 25.

- 10 A procedure for the use of the apparatus for the determination of the filling value and the air-flow impedance of a sample of cut tobacco will now be described.

A sample of cut tobacco of predetermined weight and moisture content is fed uniformly into the cylinder 6. In Fig. 1 reference numeral 32 designates such a sample. With the cylinder 6 in its operative position, the piston 23 is lowered gently onto the sample 32 and is allowed to descend freely under gravity to compress the sample 32. Initially the platform 25 carried no weights. Pressure drop measurements of the sample 32 are made at intervals of, for example, two minutes by inducing an air flow through the sample under action of the aforementioned suction pump and recording readings from the aforementioned micromanometer. Because of the presence of the critical flow orifice 16 in the duct 13, it is ensured that the air flows through the sample 32 at a fixed flow rate of, for example, 50 l min^{-1} .

As the piston 23 descends in the cylinder 6, the core 30 of the LVDT 29 descends in contact with element 31. Thus readings of the position of the piston 23, and thus of the height of the columnar tobacco sample 32, are continuously available. Such readings may be recorded at intervals of, for example, two minutes.

Weights are sequentially placed on the platform 25 at intervals of say, eight minutes. By way of example, the first weight 26 is 2.0 kg and the subsequently applied weights are 3.0 kg, 3.3 kg and 4.0 kg respectively, the weight of the piston assembly 20, 23, 25 being 1.7 kg.

Fig. 2 shows an example of a plot of pressure drop against time for a sample of cut tobacco subjected to the just described test procedure.

Fig. 3 shows an example of a plot of tobacco column height against time the readings for which were obtained during the same test procedure from which the readings for the plot shown in Fig. 2 were taken. The plot shown in Fig. 3 characterizes the filling value of the tobacco.

60 CLAIMS

1. Apparatus for use in the determination of filling value and gas-flow impedance of tobacco, comprising a cylinder, a piston movable in said cylinder towards tobacco support means extending across the interior of said

cylinder, each of said piston and said tobacco support means being permeable to gas flow thereacross, and gas-flow duct means communicable with a chamber to the side of said tobacco support means remote from said interior of said cylinder and bounded by said tobacco support means.

2. Apparatus according to Claim 1, wherein the gas-flow pressure drop across said piston plus said tobacco support means does not exceed about one millimeter water gauge.

3. Apparatus according to Claim 1 or 2, wherein at least at its end closer said tobacco support means said piston is clear of the wall of said cylinder.

4. Apparatus according to Claim 3, wherein the clearance between said piston and said wall is not less than about 2.5 millimeters.

5. Apparatus according to any preceding claim and comprising guide means operable to constrain said piston to move co-axially of said cylinder.

6. Apparatus according to any preceding claim in association with gas-flow induction means communicable with said gas-flow duct means.

7. Apparatus according to any preceding claim in association with manometer means communicable with said chamber.

8. Apparatus for use in the determination of filling value and gas-flow impedance of tobacco, substantially as hereinbefore described with reference to Fig. 1 of the accompanying drawings.

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